

**COAL SLURRY OBSERVED AS HABITAT FOR  
SEMIAQUATIC BEETLE *LANTERNARIUS  
BRUNNEUS* (COLEOPTERA: HETEROCERIDAE),  
WITH NOTES ON WATER QUALITY CONDITIONS<sup>1</sup>**

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**ABSTRACT:** The variegated beetle, *Lanternarius brunneus* (Melsh.), was found inhabiting a slurry area at an orphaned coal mine site in Illinois. Water quality analyses indicated the beetle lived in coal fines and mud saturated with water indicative of acid mine drainage, i.e., pH <4.0 and elevated sulfate and heavy metal concentrations. This is the first report of Heteroceridae occurring in this type of habitat and in conditions normally toxic to other aquatic or semiaquatic insects.

Scant information exists concerning the biology and environmental tolerances of Heteroceridae. This note reports an unusual habitat type, with accompanying water quality conditions, for *Lanternarius brunneus* (Melshemer).

Habitat for larvae and adult Heteroceridae is listed as mud, sand, or clay along the banks of rivers, streams, lakes, and ponds where they construct galleries in which to live and breed (Pacheco, 1963; Arnett, 1973; Brown, 1972). Except for legs adapted for burrowing, the Heteroceridae have no physical or respiratory specializations for aquatic life, and will leave their galleries if they are flooded with water (Dillon and Dillon, 1972). However, close association with water results in saturation of their habitat and its exposure to the water quality conditions of the neighboring water body.

On 2 June 1976 numerous galleries of *Lanternarius brunneus* were observed in the coal slurry refuse area of an orphaned mine site near Staunton, Macoupin County, Illinois. The heterocerid galleries, composed of fine coal and mud, occurred along the shoreline areas of small bodies of standing water in the slurry area. Other than water striders, the heterocerid was the only semiaquatic or aquatic macroinvertebrate collected from the slurry refuse area. The extent of slurry refuse occupied by the galleries indicated that the beetles were tolerant of the harsh environmental conditions. Heteroceridae have been reported to be scavengers or predators and to feed upon unicellular algae (Pacheco, 1963; Pierre, 1946). Terrestrial insects were commonly sited in the slurry area. Also, an unidentified unicellular green alga was observed on the bottom of water-covered parts of the slurry area. It can therefore be assumed that a food source for the beetles existed.

As is common in midwestern orphaned mine sites, the coal slurry refuse area was severely impacted by conditions associated with acid mine drainage, i.e., low pH and high heavy metal and sulfate concentrations. The standing water adjacent to the heterocerid galleries had the following water

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quality values: pH - <4.0, conductivity - 7500  $\mu$ mhos/cm (at 25°C), acidity - 4413 ppm, alkalinity - 0.0 ppm, sulfate - 3875 ppm, chloride - 159 ppm, calcium - 458 ppm, sodium - 98 ppm, and magnesium - 237 ppm. Values for some of the heavy metals analyzed were: Fe - 1810 ppm, Mn - 31.9 ppm, Cd - 0.87 ppm, Pb - 15.7 ppm, Zn - 95 ppm, Cu - 0.69 ppm, Al - 482 ppm, and Ni - 2.65 ppm.

The heterocerid *Lanternarius brunneus* is able to tolerate the extreme acid mine drainage conditions reported above. Only two other publications were found that reported water quality values for heterocerids. Roback and Richardson (1969) found *Heterocerus ventralis* (Melsh.) at a site receiving intermittent acid mine drainage. Water quality conditions, however, were not as severe as that in the Staunton slurry area, i.e., pH - 7.2, conductivity - 683  $\mu$ mhos/cm, acidity - 9.0 ppm, alkalinity - 62 ppm, sulphate - 330 ppm, chloride - 24 ppm, calcium - 98 ppm, magnesium - 27 ppm, manganese - 1.58 ppm, Fe - 2.48 ppm, Pb - 0.13 ppm, and Cu - 0.1 ppm. La Rivers (1950), reporting Nevada distribution records, noted that *Lanternarius brunneus* had been collected from the Hot Springs area at a pH ranging from 7.1 to 8.5.

*Lanternarius brunneus* can clearly tolerate an environment saturated with poor quality water that would be toxic to other aquatic insects, e.g., zinc and iron (see Clarke, 1974). It would be of interest to determine whether *L. brunneus* is unique in the Heteroceridae in being able to inhabit coal slurry refuse areas, or whether the entire family can tolerate such conditions.

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#### LITERATURE CITED

- Arnett, R.H., Jr. 1973. The beetles of the United States (A manual for identification). The American Entomological Institute, Ann Arbor, 1112 pp.
- Brown, H.P. 1972. Aquatic dryopoid beetles (Coleoptera) of the United States. U.S. Environ. Protection Agency Ident. Man. No. 6. 82 pp.
- Clarke, R. McV. 1974. The effects of effluents from metal mines on aquatic ecosystems in Canada. A literature review. Environ. Can. Fish. Mar. Serv., Tech. Rep. No. 488. 150 pp.
- Dillon, E.S., and L.S. Dillon. 1972. A manual of common beetles of Eastern North America. Vol. I. Dover Publications, Inc., New York. 434 pp.
- La Rivers, I. 1950. The Dryopoidea known or expected to occur in the Nevada area (Coleoptera). Wasmann J. Biol. 8(1):97-111.
- Pacheco, F. 1963. Systematics, phylogeny, and distribution of the variegated beetles (Coleoptera: Heteroceridae) of the New World. Ph. D. Diss., Univ. Ill., Urbana. 276 pp.
- Pierre, F. 1946. La larve d' *Heterocerus aragonicus* Kiesw. et son milieu biologique. (Col. Heteroceridae). Consideration sur la morphologie et la biologie des premiers stades de cette famille. Rev. Franc. Ent. 12(4):166-174.
- Roback, S.S., and J.W. Richardson. 1969. The effects of acid mine drainage on aquatic insects. Proc. Acad. Nat. Sci. Phila. 121:81-107.